Microfluidics is the key to make flow cytometry accessible to everyone, anywhere.«

Division Bioanalytis & Diagnostics at Fraunhofer IMM – your partner for industrial-relevant research

Flow cytometry is a standard tool for quality control in all technical processes involving biological cells, but it is also invaluable for research and development labs due to its ability to reliably gather information about cell populations, down to the single-cell level.

We provide R&D for microfluidic-based analysis systems with applications in life sciences, medical research and diagnostics, food safety or biotechnology.

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Precision, speed, and simplicity

Microfluidic technologies for the automation and down-sizing of flow cytometry

Flow cytometry – automated and miniaturized

Automation of flow cytometry

Flow cytometry requires many **manual, labor-intensive steps** which so far lack automation: A sample needs to be taken, centrifuged to remove media, stained and incubated, washed by centrifugation, then measured. These tasks massively increase costs, especially for personalized, cell-based therapies. Our microfluidic technology, engineered specifically for in-process control and phenotypic analysis, is a closed, sterile, and decentralized solution which brings lab-grade consistency to the point of need, delivering repeatable staining quality with minimal hands-on time and near-zero carryover.

At the heart of our technology is an optimized **microfluidic chip** that automates the full staining workflow: configurable pre-wash, controlled incubation, and efficient post-wash; each fine-tuned to minimize nonspecific binding, reduce dead volume, and prevent sedimentation.

Our viscoelastic buffer exchange strategy keeps dilution low while maintaining **gentle handling** of sensitive cells. Incubation times, reagent concentrations, and migration channel geometries are rigorously optimized to achieve fast turnaround per sample, short quick-rinse cycles between runs, and exceptionally low carryover. The result is consistent staining intensity, robust viability, and dependable panel performance without cleanroom infrastructure.

Miniaturization of flow cytometry

A **miniaturization** of flow cytometry instruments is necessary to help with automation tasks, as smaller devices can be more readily integrated into fluidic systems. Additionally, down-sizing makes flow cytometry accessible in the field, e.g., for drinking water analysis at the point of need.

We have developed microfluidic chips where the detector optics are integrated into a **very small package**. By making use of confocal detection techniques and a smart tuning of channel dimensions, the need for hydrodynamic focusing can be eliminated.

Further miniaturization can be achieved by employing **fluorescent-lifetime-detection techniques**, which allow for the complete omission of optical filters.

Our expertise to meet your challenges

- fast prototyping techniques (3D printing, milling, hot embossing, injection molding)
- assay development on microfluidic cartridges
- system integration
- highly motivated and interdisciplinary team of scientist and engineers
- broad test infrastructure with the opportunity to cooperate with strong scientific partners opportunities for cooperations in publicly funded projects and flexible contract research